Case Study

Engineering innovation for Africa's largest mining development in Simandou, Guinea

Replacing massive concrete culverts with lighter soil-steel crossings

ViaCon developed two large-span soil-steel crossings for the Simandou Mining Project in Guinea, replacing a conventional reinforced concrete concept with a solution better suited to extreme mining loads, deep cover conditions and demanding site logistics.

The Challenge

At the Simandou Mining Project in Guinea, the original design for two internal mine road crossings was based on large reinforced concrete box structures with spans of approximately 9–10 metres.

The structures had to carry exceptionally heavy traffic from XDE260 Electric Drive Dump Trucks. One of the crossings also had to perform under around 15 metres of fill, creating demanding load conditions from the combination of deep cover and heavy-haul mining traffic.

Under these conditions, the concrete alternative would have required walls approaching 2 metres in thickness. This would have resulted in very heavy structures, extensive concrete works, more difficult logistics and a longer construction programme in a remote project location.

The client needed a solution that could safely carry extreme mining loads, perform under deep fill, reduce construction complexity and support efficient project delivery.

The Solution

ViaCon proposed two corrugated steel structures, each designed to suit the specific conditions at the crossing location.

For the upper crossing, located beneath approximately 15 metres of cover, ViaCon designed an open shape structure with a span of 13.08 m, a rise of 7.20 m and a length of 113.6 m, supported on reinforced concrete foundations.

For the lower crossing, ViaCon designed a closed circular structure with a span of 10.80 m and a length of 109.1 m, optimised for cover depths of approximately 4–5 metres while still meeting the required heavy-haul load capacity.

The soil-steel solution made use of the structural interaction between the corrugated steel shell and the surrounding engineered backfill. This composite behaviour enables efficient load redistribution and reduces the forces transferred directly to the structure.

Compared with the original concrete concept, the solution significantly reduced the amount of concrete required. By integrating the structures into the embankments, the need for large headwalls and wing walls was reduced or eliminated. For the closed circular structure, concrete works were kept to a minimum.

The modular nature of the steel components also simplified transport and on-site assembly, which was a major advantage in the remote mine location.

Technical specification

Project: Simandou Mining Project

Location: Guinea

Application: Two internal mine road crossings

Structure type: One open shape soil-steel structure and one closed circular soil-steel structure

Upper crossing span/rise/length: 13.08 m / 7.20 m / 113.6 m

Lower crossing span/length: 10.80 m / 109.1 m

Cover depth: Approx. 15 m at upper crossing, approx. 4–5 m at lower crossing

Traffic loading: Heavy-haul mining traffic including XDE260 Electric Drive Dump Trucks

Foundation: Reinforced concrete foundations for open shape structure

The ViaCon advantage

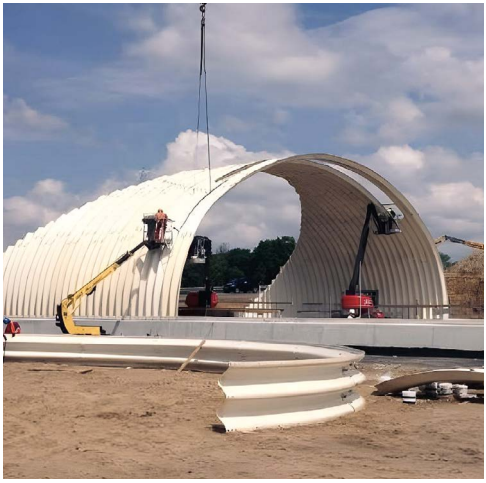
The Simandou project demonstrates the benefits of soil-steel structures in demanding mining applications.

Compared with a traditional reinforced concrete solution, ViaCon's proposal offered:

- lower structural weight
- reduced concrete works
- simplified transport and site logistics
- faster and safer installation
- efficient performance under heavy-haul traffic and deep fill
- improved tolerance to differential settlement
- long-term durability with corrosion-protected steel
- estimated embodied CO_2 reduction of more than 50%

ViaCon also carried out detailed engineering work for the project, including finite element analysis, soil-structure interaction modelling, heavy-haul load verification, structural calculations, technical drawings and assembly documentation.

By replacing massive reinforced concrete culverts with optimised soil-steel structures, ViaCon delivered a lighter, faster and more sustainable solution for critical mine infrastructure at Simandou. The design met the project's demanding structural requirements while reducing construction complexity, improving logistics and lowering environmental impact in one of Africa's largest mining developments.



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